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ECOLOGICAL AND BEHAVIOR NOTES ON THE WASP, *POLISTES PALLIPES*.

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The season of activity of *P. pallipes* begins about the last of April. My notes show that on April 24, 1920, a survey of the Wickes* region discovered no wasp enterprises whatsoever; April 28 in 1921 found a few queens out on the flowers and a few just beginning their nests; the most progressive had completed three cells. On May 28, 1920, plenty of nests were present but they showed only a limited variation in size; twenty-one were scanned, and they were all within the limits of ten to twenty cells to a nest.

The eggs adhere rigidly to the walls of the cells. Despite rough handling in knocking the nests from the walls, and transporting them long distances, the eggs are never lost. The larvae adhere just as rigidly to the walls, and any attempt to remove them with the forceps invariably destroys them. The larger larvae, half grown or more, are not glued by their tails to the wall of the cell, and can be easily removed with forceps; however, the fatling soon fills the cell so tightly that there is no danger of its falling out. The young need the protection of this anchorage, but its origin is in the egg. This is glued to the wall, and the young larva in hatching does not leave the egg, but the egg merely changes into a larva which still adheres to the cell by the original attachment.

The larvae spin the caps that cover the cells when they are about to pupate. This is often seen in orphan cells. People somehow get the erroneous impression that this function is performed by the workers by covering the cell with the same papery material of which they make the nest. Close inspection of *Polistes* nests show that each cell is composed of two kinds of material, the papery material and spun silk. Not only do the larvae spin the lids of the cells, they often enlarge the cell from one-fourth to one-third of its length. The line where the additional material is attached is conspicuous, the silk being very white and tough against the dark gray and brittle paper. The larvae then assist to a very great extent in building the nest, yet seldom get credit for doing anything useful.

In the small nests, when only the queen is present, we find the first eggs deposited in the first cells which later become the center ones when others are added to the circle. The first larvae appear in these center cells, and naturally are in advance of the others in development. However, one sometimes finds large larvae in the cells about the periphery, and eggs in the center cells. Undoubtedly, in such case either some accident has befallen the first offspring, and these eggs have been desposited to replace the loss, or else these cells are being used a second time. We have of course definite records of instances where *P. pallipes* uses cells more than once. One large nest on August 6 had eggs in nineteen old central cells, in addition to seventeen eggs in as many new cells in the outer row.

*—Twenty-two miles south of St. Louis, Mo.

In another nest taken on the same date, eleven center cells which had been used for the first brood then contained eggs. On the other hand, in several nests of *P. pallipes*, that I watched from the start, I found that the old interior cells were bitten out, probably to construct cells elsewhere on the nest.

One often sees an egg deposited in the merest excuse for a cell, just a shallow hollow that is barely a roof over the egg. Once I found a nest with the cells all filled and three eggs laid on the outside of the nest, in the depressions between cells; the mother had evidently laid the eggs expecting the workers to build a house over them.

On one occasion a *P. pallipes* queen was seen on the nest with a large mass of caterpillar meat which she was working in her mouth. Whether she intended to distribute it among the larvae and changed her mind because of my presence, I do not know, but she paused and slowly and daintily ate the morsel herself. Another queen was seen dividing the mass of brown caterpillar pulp among the various young. Working a bit off the whole until it was about to sever, she poked it into the cell, and when she withdrew I could see the larva eating it. It is surprising what a short time (only a few seconds) the larvae take to gulp it down. We know that in orphan nests trophallaxis occurs, and I was anxious to see if in a nest with a single queen the same thing happens. In this one case it did not, although I waited many minutes after the feeding for the familiar reactions described elsewhere for workers.*

Both *P. pallipes* and *P. rubiginosis* were actively engaged in foraging in the cabbage patch in the last week in July. Often they would disappear deep into a cabbage-head and come out with a mouthful of green caterpillar meat. In this rummaging about they often collided with the cabbage bugs, *Murginata histrionica*, but they made no effort whatever to capture these. On other occasions they were seen getting nourishment for themselves from plants, chiefly the goldenrod and buckbrush flowers.

Formidable as this insect appears, it is often the victim of various enemies. On June 24 I found that just one-half of the nests of *P. pallipes* which I had marked for further observation had met with a mysterious mishap; they were without occupants and the contents were gone. It is nothing uncommon to find nests deserted and ants carryig away the contents of the cells, but in these nests it seemed that they had been attacked, probably by a bird; the nests had been punctured on the sides and the larvae taken, as had probably the mothers also. Ants do not leave these signs of violence when they despoil abandoned nests. On one long porch which harbored about a dozen nests, all were destroyed thus by ants identified by Dr. Mann as *Camponotus fallax decipiens* Em., except one which was in a narrow, secluded crevice. The same condition obtained in a small shed; the only survivor there was one which was in an out-of-the-way corner.

Polistes pallipes nests are often infested by an unknown parasite, (Hymenopterous) that spins covers over tops of the cells as shown in the figure.

When one sees the havoc done by enemies, one little wonders that the queen, when she has no workers seldom leaves the nest. On June 23, as I work-

*—See article in Psyche 35: 153-156, 1928.

ed about the clay bank, I kept close watch on two nests. In one nest without workers, the queen did not leave the nest once between 7 a.m. and 5 p.m., while in a neighboring nest with two workers, during the same period of observation the queen (marked) left the nest seven times and remained away for periods of from 5 minutes to 95 minutes.

We have recorded elsewhere how *Polistes* can alight on the water for a drink with perfect safety. Sometimes accidents happen, however, for on September 7 a *P. pallipes* were seen dead, floating on the water while a fish was nibbling at the carcass. A second specimen, a *P. rubiginosus,* was seen in the same situation. These disasters might have been due in part to the weaknesses of old age at that season of the year.

Although these wasps seem so abundant, and I have watched their activities from spring to autumn, yet they have evaded me at the time of the meeting of the sexes, so I do not yet know their mating habits. I have only found that the males emerge early in August. One male emerged as early as July 17, but this might have been from an egg laid by a worker. One *P. pallipes* nest was taken near St. Louis that gave forth two males on August 7. Other nests under observation produced one male each on August 8 and 10, two on August 12 and two on August 13.

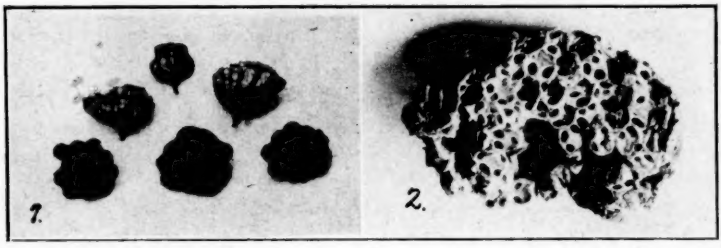

Fig. 1. Newly begun nests of *P. pallipes.*
Fig. 2. A parasitized nest of *Polistes pallipes.*

A study of the early nests of *P. pallipes* was made to find out whether, since all the queens are at hand and fully mature when spring opens, they all begin work at the same time, and also whether they all accomplish about the same amount while working single-handed in the early part of the season.

On April 28, forty-two nests of *P. pallipes* were examined. The number of cells in each varied from 2 to 14, as shown below:

Nests with 2 cells .. 2	Nests with 7 cells .. 8	Nests with 11 cells .. 6
Nests with 4 cells .. 6	Nests with 8 cells .. 6	Nests with 12 cells .. 1
Nests with 5 cells .. 4	Nests with 9 cells .. 3	Nests with 14 cells .. 2
Nests with 6 cells .. 3	Nests with 10 cells .. 1	

All of these contained some eggs except the following, in which no eggs had yet been deposited: one twelve-celled and one eight-celled nest, both of which had two queens and were soon after deserted, one eight-celled nest, four nests of four cells each, two of seven, one of eight and one of nine. These details are

recorded merely to show that laying eggs in the cells is due to physiological readiness or individual temperament more than to the completion of the cells or the size of the nest. I have found in early nests without workers two-celled nests containing eggs, and often large nests of ten or twelve cells without eggs.

On May 13 I examined the 36 nests which then remained; the other six had by this time been devastated. The number of cells to the nest varied from 8 to 18, in the following proportions:

Nests with 8 cells .. 5	Nests with 12 cells .. 6	Nests with 15 cells .. 2
Nests with 10 cells .. 10	Nests with 13 cells .. 2	Nests with 16 cells .. 5
Nests with 11 cells .. 3	Nests with 14 cells .. 2	Nests with 18 cells .. 1

The great majority of these nests contained eggs. A few cells were empty, and six nests contained larvae in the following numbers: 3, 1, 1, 2, 1 and 12. One 16-celled nest cannot be compared with the others since it was under the care of three queens. This survey shows, however, that while there was a good deal of similarity in the amount of work accomplished by these wasps, yet it is evident that some do excel in industry or at least in success.

Just two weeks later, May 27, another examination was made. By this time, ten more of the nests had been deserted or broken into by birds; this left only 26 nests. Five new ones were discovered in the same region; these were small nests containing only eggs, and in all probability had been as a second attempt by queens that had deserted or lost their first nests. An examination of the nests on that date showed eggs and larvae, and in five nests, pupae, which numbered 2, 2, 2, 5 and 1. The cells in all the nests now varied from 9 to 19, excepting the three-queen nest (omitted in the table) which now had 32 cells.

Nests with 9 cells .. 1	Nests with 13 cells .. 2	Nests with 17 cells .. 1
Nests with 10 cells .. 1	Nests with 14 cells .. 4	Nests with 18 cells .. 2
Nests with 11 cells .. 3	Nests with 15 cells .. 4	Nests with 19 cells .. 2
Nests with 12 cells .. 2	Nests with 16 cells .. 3	

This shows only a slight increase over the number of cells recorded two weeks earlier. For this length of interval, one would expect a greater increase, excepting for the fact that we were reaching the time in the season and in the lives of the queens when every atom of energy must go to provide for the nestlings; there was little time for pulp gathering or cell making.

On June 23, at my next visit, the nests were reduced in number to 17. The elimination of whole nests is indeed astonishing; here in the first five weeks, 60 per cent of the colonies had been annihilated. The number of cells had increased but little; the 32-celled nest remained just the same, while the others varied from 9 to 26 as follows:

Nests with 9 cells .. 1	Nests with 13 cells .. 1	Nests with 17 cells .. 1
Nests with 11 cells .. 2	Nests with 14 cells .. 3	Nests with 18 cells .. 2
Nests with 12 cells .. 2	Nests with 16 cells .. 3	Nests with 26 cells .. 1

The nests at this date contained cells in all conditions, with eggs, with larvae, with pupae, and empty.

I have been stung several times by *Polistes pallipes*, but only twice did the pain last more than a half-hour. On one of these occasions the injury was in

a sensitive spot—the eyelid—, and the other, the most severe of all, was on the wrist; after ten minutes the red spot left by the sting was encircled by a white welt and a swelling which remained for six hours, paining severely for the first two hours and slightly for the next two. I am undecided whether to attribute the unusual severity of this sting to the condition of the wasp at that season of the year—August—, or to the duration of the insertion of the sting, or to my own reduced vitality that day after a recent illness.

On another August morning, when I was attempting to place a lost wasp on a *P. pallipes* nest, one of the workers attacked my hand, clinging to my little finger with its legs and administering a fierce and prolonged sting just above the root of the nail. For five minutes I was in real agony; then the finger became much swollen from tip to base and was slightly numb, with intermittent sharp pains. Since this unusually painful sting following a long insertion of the sting, it is natural to conclude that the pain is in direct relation to the amount of poison injected. I might say, to the credit of this wasp, that the usual sting is a mild one, the pain lasting from 5 to 15 minutes.

A NEW SPECIES OF EUXOA AND SOME NOTES ON CHORIZAGROTIS (LEPIDOPTERA).*

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During the past four or five years, several puzzling specimens of a form of Euxoa closely related to *plagigera* and *oblongostigma* have been collected in various parts of Montana. Some examples were submitted to Dr. McDunnough in the winter of 1927-8, and he reported as follows: .

This form has always puzzled me; it occurs in Utah and I believe it to be a brown form of *plagigera* but some run very close to *oblongostigma* and are very hard to separate without genitalic slides.

As only a few species were involved, the matter was allowed to rest there. During the past summer (1929) this form has been quite common in the Nigger Hollow area, and a long series has accumulated. Upon further study, the form seems genitalically distinct from *plagigera* and more closely related to *oblongostigma*. It seems possible that the form may be a hybrid of these two species, but at the present time it is apparently breeding true, as several pairs of each of the forms involved have been taken in coitu, but in each case both sexes represented the same species. Flight data from collections at Nigger Hollow, substantiated by smaller flight in other places, indicate that the peak of flight of the new form is at least two weeks earlier than either *plagigera* or *oblongostigma*. For these reasons it seems advisable to regard the brown form as a distinct species, and I take great pleasure in dedicating it to Dr. J. McDunnough, who has been very generous with his time and labor in helping to untangle the systematic puzzles involved in our cutworm studies.

Euxoa mcdunnoughi n. sp.

♂. Head, light brown, a definite black crossbar just above the base of the antennae. Palpi, light brown, with admixture of black and white scales.

*—Contribution from Entomology Department, Montana Agricultural Experiment Station.

Collar, grayish brown below, light brown above with a central black line. Patagiae brown, with edging of white outside a black line. Primaries light brown. Costa usually grayed yellow, sometimes brown, but always with a definite gray line just below, extending beyond cell. A submedian gray line extending to the reniform. Transverse anterior line faintly marked by two narrow darker lines enclosing a stripe somewhat lighter than ground color. Transverse posterior line never definite, sometimes indicated by a lighter shade toward margin. Subterminal line indicated by darker preceding and following shades, not crossed by the four dentate marks characteristic of this group. A series of dark sagittate marks just inside this line. Fringes variable, usually paler at the base. Secondaries yellowish, with a darker outer shading and lighter fringes. Smoky beneath.

♀. Tends to be somewhat darker and more distinctly marked, with yellow partially replaced by gray.

Genitalia typical of the group. Claspers somewhat more slender than those of *plagigera,* asymmetrical, the outer arm on the left side of the insect being shorter than that on the right.

Holotype. Jefferson County, Montana July 19, 1927.

Allotype. Jefferson County, Montana July 19, 1927.

Paratypes. Eighteen ♂ ♂ and ten ♀ ♀, Jefferson County, Montana various dates in July 1926-1929, two ♂ Malta, Montana June 30, 1929, July, 1929. Type and allotype in Montana Experiment Station collection. Paratypes in Montana Experiment Station collection, author's collection, Canadian National Collection.

This species is intermediate between *plagigera* and *oblongostigma.* It may be immediately separated from *plagigera* by the brown color of the primaries, and from *oblongostigma* by the grayish yellow color of head and lower part of collar.

The Army Cutworm has for many years been regarded as a mixture of several species of the genus *Chorizagrotis* Smith. The various forms involved are *auxiliaris, introferens, agrestis, inconcinna* and *thanatologia.* Two other names are involved, *mercenaria* Grote, which is a synonym of *agrestis,* and *soror* Smith, which is merely a faded form of *auxiliaris.* The taxonomic status of these first five forms has been somewhat in dispute. Barnes and McDunnough (1) have listed *introferens* as a form of *auxiliaris.* Wolley-Dod (3) states that he has bred *auxiliaris, introferens* and *agrestis* from a single known parent. In the course of our studies of the Army Cutworm we have reared hundreds of larvae to the adult stage and among these adults there are one hundred and eighty-seven moths from known female parents. As a result of these studies the following facts have been obtained.

1. *Introferens* is the male of *auxiliaris.* In handling over 2000 specimens of this group, I have never seen a male with a gray costa (*auxiliaris*) or a female with a yellow costa (*introferens*), and many pairs have been collected in coitus in the field. The yellow and gray costal shading is a sexual character which is found also in *Euxoa quadridentata* G. & R. and in *Euxoa laetificans* Smith.

2. *Agrestis* forms of both sexes have been bred in number from the eggs of *auxiliaris* females, making this rank as a color form.

3. *Soror* females have been repeatedly found in rearings from *auxiliaris* females at low temperatures, and are so close to the typical form that this should be regarded as a synonym.

4. *Agrestis,* as now recognized, occurs in two color forms, of which the typical form is a dull gray or brown, with the markings almost obsolete. In the same rearings may be found moths of both sexes, without constrast on costa or collar, but with the normal Phalaenid maculation, giving a variegated appearance. Wolley-Dod (2) mentions this as a form of *agrestis,* which it is, but does not name it. In order to avoid further confusion, this form is described below as *Chorizagrotis auxiliaris* form *montanus.*

Using the terminology of Barnes and McDunnough (1) the synonymy of the group is as follows:

Chorizagrotis auxiliaris *Grote*
soror Smith
♂, *introferens* Grote
form agrestis *Grote*
mercenaria Grote
form montanus *n. f.*

The various forms may be separated as follows:

(1). Costa contrasting yellow or gray ..... (2).
Costa concolorous with rest of wing ..... (3).
(2). Costa yellow ♂ ..... *introferens.*
Costa gray ♀ ..... *auxiliaris.*
(3). Fore wing even gray to red brown, transverse markings very indistinct ..... *agrestis.*
Fore wing mottled or variegated, transverse markings distinct .. *montanus.*

Inconcinna is rather difficult to separate from *agrestis* in the female. The male genitalia are apparently quite different, to judge from a sketch received from Dr. McDunnough. The shorter arm of the harpe is much more strongly developed than in the forms of *auxiliaris.* In Smith's Revision of Agrotis his figure 48, of *inconcinna* agrees well with that mentioned above. It seems possible that his Figure 46, which he figures as *introferens,* may also be this species, although it is very close to some mounts of *thanatologia* var. *perfida* Dod. which I have made.

In rearing *agrestis* at low temperatures, forms are found which closely approach *perfida* superficially, but are larger, and the genitalia are distinct. A few such forms have also been secured in the field, and are puzzling to separate.

Both *agrestis* and *montanus* seem to be germinal variations, as they are unaffected by temperature except in the intensity of the markings. *Montanus* is very common in Montana and Alberta, but is rare further south, to judge from what material I have seen. It seems probably that Mendelian characters are involved, but this can only be proven by intensive rearings in which both parents are known.

Chorizagrotis auxiliaris form **montanus,** new form.

The fore wing has a decided variegated back-ground caused chiefly by the presence of a considerably lighter ground color between the transverse posterior

line and the subterminal line. The ordinary spots are usually filled with gray or yellow gray and there is usually a distinct median shade in the lower part of the wing. The form may be distinguished from typical *auxiliaris* by the fact that the costa is not contrastingly gray and the transverse maculation is complete. It may be distinguished from typical *agrestis* by the presence of the lighter area between the transverse lines and the more contrasty markings which give it a decidedly variegated appearance somewhat resmbling *Euxoa pleuritica*.

Holotype, ♂ Malta, Montana, May 23, 1929.

Allotype, ♀ Jefferson County, Montana June 28, 1926.

Paratypes: Ten ♂ ♂ and fourteen ♀ ♀ as follows: Three ♂ ♂ and nine ♀ ♀ Bridger Mountains (Gallatin County) Montana, July 12, 1927, one ♀ same July 6, 1925, one ♂ Jefferson County Montana, July 7, 1925, one ♂ same, June 28, 1926 one ♂, one ♀ same July 19, 1927; one ♂, one ♀ same June 27, 1928, one ♂ Bozeman, Montana June 22, 1925, one ♀ same September 12, 1929, one ♂ Hamilton, Montana June 25, 1925, one ♂ Hill County, Montana, July 4, 1922, one ♀ July 9, 1922.

Holotype, allotype, in collection Montana Experiment Station, paratypes in same collection, author's collection, Canadian National Collection.

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ANOPHELES QUADRIMACULATUS SAY IN COLORADO. (DIPTERA).

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A study of the distribution of mosquitoes from Colorado discloses many areas which have not as yet been reported. Among the collections we find only one report of *Anopheles* and its identification has been uncertain. Cockerell[1] lists seventeen species of mosquitoes from Colorado or Wyoming. Among these is listed *Anopheles quadrimaculatus* Say taken at Hotchkiss and Delta in Delta County by G. P. Weldon and recorded by Howard, Dyar, and Knab. He states: "We have so far found no trace of *Anopheles* in our collections." (p. 198) Dyar[2] lists *Anopheles quadrimaulatus* Say from Hotchkiss as collected by G. P. Weldon, Aug. 20, 1911. Later Dyar[3] lists twenty-four species of mosquitoes from Colorado. *Anopheles quadrimaculatus* Say is listed, but he reports, "The determination is uncertain until verified by a male. The specimen mentioned from Hotchkiss and Delta in the Monograph (Howard, Dyar, and Knab., Mosq. No. & Cent. Am. & W.I., iv, 1032, 1917) cannot now be found," (p. 40) and again, "The species actually present may be *maculipennis* Meig., males being necessary to decide." (p. 41) Dyar[4] gives the distribution of *Anopheles quadrimaculatus* Say as being "'Atlantic States and Mississippi valley from New York and Illinois to the Gulf of Mexico, Mexico." (p. 454). Of the distribution of *Anopheles maculipennis* Meig. Dyar[4] states," ....New Mexico at high altitudes, ... and probably through the Rocky Mounains." (p. 452).

Our specimens of *Anopheles quadrimaculatus* Say were collected in July of 1928 and August of 1929 six miles northwest of Grand Junction (Appleton) in close proximity to the main highway. Identification was made from three adult females and seven larvae. Through the kindness of Mr. Harold Morrison in charge of Taxonomic Investigations, and Mr. C. T. Greene of the Bureau Staff, U. S. Dept. of Agriculture, Bureau of Entomology, the identification of the adults have been confirmed. The larvae were cleared in creosote and identified from the key for *Anopheles* larvae as given by Dyar[4], but their identification was less certain.

Two of the females were captured early in the morning on the screen of a sleeping porch and the third in the house about 8.30 o'clock in the evening. Herms[5] and Hardenburg[6] both state that *Anopheles quadrimaculatus* Say enters buildings readily, through openings in the screening or through other openings, but leaves the house during the day. Inspection of mosquitoes found in the house during the day did not disclose any *Anopheles*.

The larvae were collected from along the edge of water which had drained from an irrigation ditch and which was forming a slow-moving stream, grown with grass and of summer duration, at the side of the main highway.

Dyar[4] states," The larvae occur in permanent ground pools, usually with algae." (p. 454) Hardenburg[6] says, "While the favorite breeding place of *Anopheles quadrimaculatus* Say is grass-bordered pools, ponds, pot-holes, etc., it has been reported to breed in slowly moving streams." (p. 28) Dyar[2] also reports the larvae as "surface feeders in water puddles, especially permanent water connected with rivers." (p. 104).

In the summer of 1929 the breeding places from which the larvae had been collected in 1928 had dried up. An adult female was found in 1929 but the breeding place was not located.

Other collections in the western part of the state will be made in 1930 to determine if possible the presence or absence of *Anopheles quadrimaculatus* Say in the regions from which it has been reported but unconfirmed.

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NOTES ON NORTH AMERICAN *CERATOPHYLLI* (SIPHONAPTERA).

BY M. A. STEWART,
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In 1928 the writer described in The Canadian Entomologist, volume LX pages 148 to 151, two species of fleas from Colorado under the names *Ceratophyllus peromysci* and *Ceratophyllus citelli*. Recent studies have shown that both of these names are synonyms.

The species described as *Ceratophyllus peromysci* Stewart is *Ceratophyllus wagneri* Baker. Baker described only the male and in the collection possessed by the writer there were only females. In 1929 (Novitates Zoologicae XXXV, page 35) Dr. Karl Jordan gave a very brief description of the female of this species and in the same year (Vol. II, Trans. Fourth International Congress of Entomology, page 498) he published figures of the female. These were the first published descriptions of the female of *C. wagneri* Baker and from these it was readily seen that a synonym had been created in describing the species *C. peromysci* Stewart.

Ceratophyllus citelli Stewart has recently been observed by the author to be the species described by Jordan in 1925 (Novitates Zoologicae XXXIII, page 107, figs, 29, 30) as *Ceratophyllus fotus*. This species was described from a single pair of fleas collected from "*Spermophilus* 13-*lineatus*" (*Citellus tridecemlineatus*) in Colorado. The original description was very meager and only the male was figured. The specimens in the writer's collection included both males and females but the males were badly mutilated. It was not until recently, when more specimens of both sexes came into my collection, that it was possible to recognize from Jordan's description that *Cerathophyllus citelli* Stewart is his *fotus*.

For some time it has been recognized by workers in the order Siphonaptera that the genus *Ceratophyllus* includes species belonging to a number of distinct genera. Dr. Julius Wagner has made outstanding contributions in the re-allocation of some of these species and in 1929 (Konowia, Bd. VIII, Heft 3, pages 311 to 315) he wrote of *C. fotus* Jordan as perhaps belonging to the genus *Oropsylla*. In the studies just mentioned the writer was able to determine with no difficulty at all that Wagner's belief is true, Thus *Ceratophyllus citelli* Stewart is *Oropsylla fotus* Jordan.

In rechecking certain North American *Ceratophylli* in an attempt to make them conform with Wagner's classification of the palaearctic species it was discovered that *Ceratophyllus labis* Jordan and Rothschild also belongs to the genus *Oropsylla* and that *C. abantis* Rothschild belongs to the genus *Paradoxopsyllus* Miyajima.

NOTES ON UTAH LACHNEA (APHIDIDAE).[1]

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The hypothetical ancestor of the Aphididae was probably a large generalized form, always winged, both sexes occurring in each generation, and with only a

1.—This is one of a series of papers treating the Aphididae of Utah. Contribution from the Department of Entomology Utah Agricultural Experiment Station. Publication authorized by Director, January 30, 1930.

2.—The writer wishes to thank Professor M. A. Palmer for looking over material of most of the species herein discussed, and for her opinions as to identity of the various forms.

few generations each year. Migration would be lacking, and the development of the aphid ancestor would probably be tied up with one of the primitive types of plants occurring in that early period. Such specialized structures as cornicles, elongate cauda, well-developed antennal tubercles and ungueuses, would be lacking, or in early stages of development. Migration would not exist, but flight would be necessary for the dispersal of the species. At that time, all generations would be very similar in appearance, feed upon the exposed parts of plants, and their habits aiding in survival would be well-developed.

At the present time, many forms of the supertribe Lachnea, and particularly of the tribe Lachnini, correspond most closely to the supposed hypothetical type suggested above.

In general, the Lachnini are large, dark forms, having only a relatively few generations each year; the wingless forms particularly are very similar to each other throughout the various generations. The aphids are long-legged, rather gregarious in habits while feeding, but run rapidly and hide when disturbed. The host plants are conifers, a group ordinarily recognized as originating in ancient times, and the habit of feeding upon the bark is rather primitive. The cauda and anal plate are not specialized as in the more recent tribes, and the alternate host plant habit has not become established.

Closely related tribes have become more specialized, having taken on other habits and differing somewhat in appearance. The Eulachnini have become smaller, have remained on the primitive host, but have largely deserted the bark and now feed upon the needles, usually acquiring lighter body colors.

The Pterochlorini have deserted the conifers, finding life more pleasant upon the woody parts of deciduous plants.

Members of the Anoeciini have taken the Pemphigini trend, the summer forms often becoming subterranean in habits, the sexes becoming small and wingless with a reduction in the wing venation.

Genus Lachnus Burmeister.

Lachnus medispinosus Gillette and Palmer

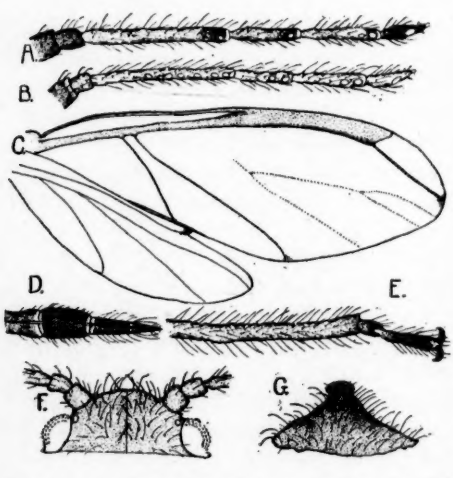
This aphid was fairly abundant near the divide in Logan Canyon, Utah, on June 23, 1925. It was found feeding upon the bark of twigs on *Pinus contorta*. Only wingless forms were collected at this time. Winged and apterous forms were collected on the same host upon the following day in Immigration Canyon, Idaho. This is a very active form when it is disturbed.

Fundatrix.—Size large, 3.6 to 3.72 mm. long and 2 to 2.2 mm. wide across the abdomen; color yellowish-brown to darker brown, with black areas and a whitish pruinose area over parts of the body; rostrum long, reaching well beyond third coxae; body and appendages armed with moderately long hairs, head with well-developed median suture; antennae armed with numerous hairs, which are somewhat longer than usual thickness of antennal segments; antennae III, 0.63 to 0.67 mm. long; IV, 0.21 to 0.23 mm., V, 0.23 to 0.26 mm.; VI, 0.12 to 0.13+0.05 to 0.06 mm.; legs long; hind tibia 2.41 to 2.6 mm. long; cornicles somewhat less conspicuous than in summer aptera, on broad, shallow, hairy cones; cauda and anal plate broadly rounded, and armed with rather long hairs.

Described from two specimens collected in Immigration Canyon, Idaho, June 24, 1925.

Apterous vivipara.—Somewhat smaller and narrower than fundatrix; antennal measurements as in fundatrix, III with 1 to 2 sensoria; IV, 1; V with 1 secondary sensorium; ungueus heavy, conical, and short, as in other forms; hairs on hind tibia rather characteristic of the species, semi-spinelike to finer, and somewhat shorter than thickness of tibia; hind tibia 2.65 mm. long; cornicles large, 0.53 mm. across base, black, and armed with long, curved hairs.

Alate vivipara.—Color brown, with black head and thorax, and with whitish powdery markings; size 3 mm. long; head broad and short, rounded in front, with distinct median suture; rostrum long, reaching middle of abdomen; antennae armed with hairs slightly longer than thickness of distal segments; antennal III, 0.57 to 0.6 mm., and armed with 6 to 8 sensoria; IV, 0.29 to 0.3 mm., with 1 to 2 sensoria; V, 0.25 mm., with one secondary, in addition to the primary sensorium; VI, 0.11+0.04 to 0.13+0.05 mm.; ungueus short, heavy, and conical; wings large, hyaline; media twice branched, evanescent; stigma dusky brown, long and narrow, rather blunt at distal end; radial sector well developed, brownish; cornicles large, black, and 0.52 to 0.60 mm. across base, and armed with rather long sensilla; cauda and anal broadly rounded.



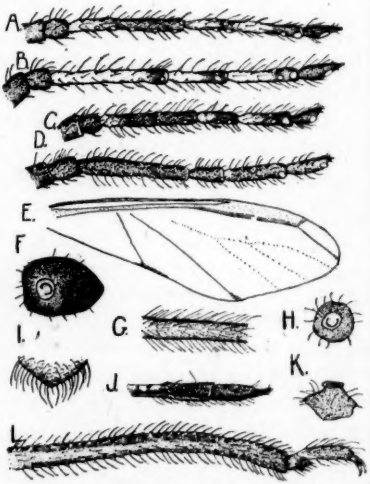


Fig. 1.—*Lachnus medispinosus* Gillette and Palmer, A, Antenna of apterous viviparous; B, antenna of alate viviparous; C, wings; D, tip of rostrum of apterous; E, distal end of tibia and tarsus of alate; F, head of alate; G, cornicle of alate.

Fig. 2.—*Lachnus edulis* Wilson. A, Antenna of alate viviparous; B, antenna of apterous viviparous. *L. edulis tanneri.* C, Antenna of alate viviparous; D, antenna of apterous viviparous; E, front wing; F, cornicle of alate; G, section of hind tibia of alate, showing length of hairs; H, cornicle of apterous; I, cauda of alate; J, distal segments of rostrum in alate; K, cornicle of apterous; L, most of hind tibia and tarsus of apterous viviparous.

Lachnus brevispinosus Gillette and Palmer

A few individuals of this active species were collected in Logan Canyon, Utah on June 23, 1925. The aphids feed upon the bark of *Pinus contorta,* and at the time of collection were less abundant than *L. medispinosus.* The writer

thought them to be the latter species, as these two forms appear very much alike when alive.

Lachnus solitarius Gillette and Palmer

A few wingless individuals of this brownish to greenish-brown form were collected at Bryce Canyon, Utah, on July 14, 1925. The aphids were feeding upon the younger bark near the tips of the twigs, on *Pinus ponderosa*. Ants (*Formica* sp.) were fairly abundant.

Apterous viviparous.—Color brown to greenish-brown; size 3.1 mm. long and 2 mm. wide across middle of abdomen; rostrum reaches slightly beyond middle of abdomen; head rounded; most of the hairs on body and appendages are heavy and spine-like; antennal III, 0.55 mm., without sensoria; IV, 0.23 mm., without sensoria; V, 0.26 mm., with one secondary sensorium besides the distal primary sensorium; hind tibia heavy, mostly black, curved, and 1.72 mm. long; cornicles blackish, and armed with numerous fine hairs and a few heavy spinelike hairs; cauda broadly triangular.

Lachnus edulis Wilson

One wingeless specimen collected by Dr. Vasco M. Tanner (of Provo, Utah) at Reservoir Creek, Raft River Mountains, Utah, is fairly close to the typical *edulis* Wilson. It was collected from *Pinus monophylla*, June 19, 1928. This form in some respects resembles *tanneri*, but in having longer hind tibia, shorter distal segments in the rostrum, and in having antennal IV less distinctly short in comparison with V it may be considered to fall within the probable range of the typical *edulis*.

Lachnus edulis tanneri n. subsp.

The material herein described as a subspecies of *L. edulis* Wilson was collected at Reservoir Creek, Raft River Mountains, Utah, by Doctor Vasco M. Tanner. Both wingeless and alate females were feeding upon single-leaf pinon, *Pinus monophylla*, June 19, 1928. Professor M. A. Palmer called the writer's attention to the difference in length of antennal segment IV in this material, compared with specimens from the same lot as those from which Doctor H. F. Wilson made his description of *edulis*.

Apterous vivipara.—Size 3.36 to 3.7 mm. long and about 2 mm. wide across abdomen; body and appendages armed with numerous fairly long, curved hairs; rostrum long, nearly reaching tip of abdomen, three distal segments of rostrum measure 0.36, 0.4 and 0.09 mm.; respectively; head rounded in front; antennae 1.11 to 1.3 mm. long and fairly thick; antennal III, 0.34 to 0.45 mm. long, and without sensoria; IV, 0.13 to 0.17 mm. long, usually with two small sensoria, but sometimes with one or no sensoria; V, 0.2 to 0.27 mm. with one to three small sensoria in addition to the distal, larger primary sensorium; VI, 0.13+0.03 to 0.14+0.04 and in one case 0.17+0.03 mm. long; hind tibia rather short and thick, 1.23 to 1.7 mm. long; cornicles rather small, and situated on black conical bases; cauda black, broad, and somewhat pointed, forming a broad angle; anal plate black and broadly rounded.

Alate vivipara.—Size 3 mm. long; rostrum reaching to or beyond cornicles, with distal segments 0.2, 0.18, and 0.08 mm. long; body and appendages armed

with numerous fairly long, curved hairs; head with median longitudinal suture; front of head broadly rounded; antennae 1.2 mm. long and black, except proximal ends of segments III, IV, and V, which are lighter; hairs on antennae long and curved, slightly longer than thickness of antennae, measuring about 0.06 mm.; antennal III, 0.43 mm. long, with 7 sensoria of various sizes, not always confined to a straight row; IV, 0.18 mm., with 2 sensoria; V, 0.22 mm., with 1 secondary sensorium besides the distal primary sensorium; VI, 0.11+0.03 mm., with short spur or unguis abruptly tapering off; forewings with two branched media evanescent; hind tibia 2.2 mm. long, nearly all black, 0.07 mm. thick at middle, and armed with numerous hairs equal to or slightly exceeding thickness of tibia at this point; cornicles on broad, black, hairy, cone-shaped bases; cauda black, broad and abruptly conical; anal plate black and broadly rounded.

This subspecies differs from typical forms of *Lachnus edulis* in having the short antennal IV, smaller secondary sensoria, longer distal segments in the rostrum, and in having shorter and thicker hind tibia in the aptera.

Lachnus hottesi Gillette and Palmer

This blackish aphid was fairly abundant upon the twig bark of *Picea engelmanni*, in Logan Canyon, Utah, on June 23, 1925. Wingless individuals were most common in the colonies, but winged forms also occurred. A number of wingless individuals were collected upon the same host plant in Immigration Canyon, Idaho, upon the following day. In Logan Canyon, this aphid was attended by *Formica cinerea* and *F. rufa*.

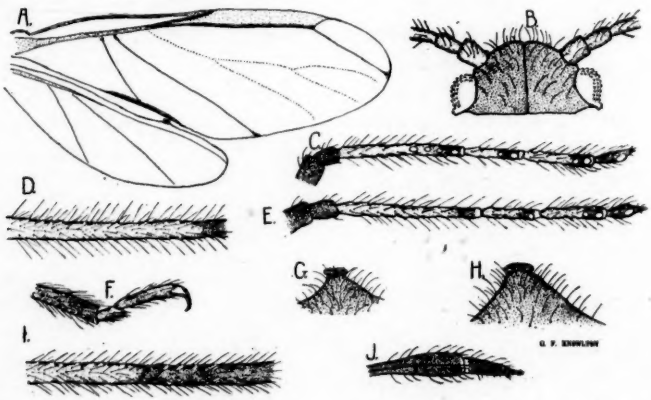


Fig. 3.—*Lachnus hottesi* Gillette and Palmer. A, wings; B, head of apterous viviparous; C, antenna of alate viviparous; D, section of hind tibia of alate; E, antenna of apterous; F, distal end of tibia and tarsus of alate; G, cornicle of alate; H, cornicle of apterous; I, section of hind tibia of apterous; J, tip of rostrum of apterous female.

Apterous vivipara.—Color black; size large, 3.2 to 3.4 mm. long; rostrum long, reaching beyond middle of abdomen; body and appendages armed with long slender hairs; head broadly rounded, with median suture; antennae 1.57 mm. long; antennal III, 0.61 to 0.63 mm., with 0 to usually 1 sensorium; IV, 0.25 to 0.27 mm., with 1 or 2 sensoria; V, 0.31 mm., with 1 secondary sensorium, besides the distal primary sensorium; VI, 0.13+0.05 to 0.14+0.06 mm.; legs long, and amber yellow on proximal lighter portions, with the rest black; hind tibia 1.8 to 2.65 mm.

long; lateral tubercles present on abdomen; cornicles black, rather large, 0.56 to 0.63 mm. across conical base; cauda black, and somewhat angular at tip; anal plate black and broadly rounded.

Allate vivipara.—Color blackish; size 2.81 to 3 mm. long; rostrum long, reaching to near tip of abdomen; body and appendages armed with long slender hairs; head rounded in front, with distinct median suture; antennae 1.5 mm. long; antennal III, 0.54 to 0.56 mm. long and armed with 4 to 7 sensoria on distal part of segment; IV, 0.25 mm., with 1 sensorium; V, 0.3 mm., with 1 secondary, plus the distal primary sensorium; VI, 0.12+0.03 to 0.13+0.04 mm.; wings large; media of front wing twice branched and evanescent, other veins being much more distinct; hind tibia 2.5 to 2.63 mm. long; cornicles obvious; cauda and anal plate rounded.

Lachnus coloradensis Gillette

This blackish aphid was very abundant upon a few Colorado blue spruce trees, *Picea pungens* Engelm., on the campus of the Utah State Agricultural College, during the summer and fall of 1926. Rather large colonies were sometimes found, feeding upon the bark of the branches and attended by the ant, *Formica fusca.* Only wingless forms were found when collections were taken on August 10, September 20, and October 13, 1926.

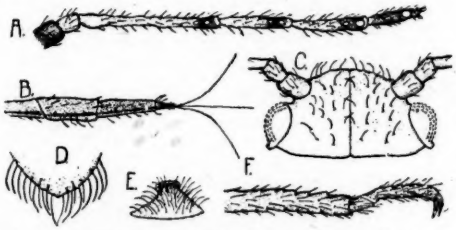


Fig. 4.—*Lachnus coloradensis* Gillette. *A*, Antenna; *B*, tip of rostrum; *C*, head; *E*, cornicle; *F*, distal end of tibia and tarsus, of apterous viviparous female. *D*, cauda of oviparous female.

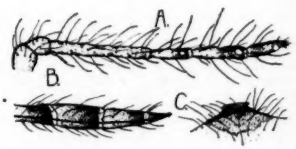


Fig. 5.—*Lachnus glehnus* Essig. A, antenna; B, tip of rostrum; C, cornicle of apterous viviparous female.

Apterous viviparous.—Color blackish to black; size 3.35 to 3.42 mm. long; rostrum long, reaching well towards end of abdomen; body hairs fairly short, compared with many species of the genus *Lachnus;* head rounded in front, with median suture; antennae 1.36 to 1.58 mm. long; antennal III, 0.54 to 0.56 mm., with 1 to 2 sensoria; IV, 0.2 to 0.23 mm. with 1 or 2 sensoria; V, 0.25 to 0.27 mm., with 1 secondary sensorium in addition to the distal primary sensorium; VI, 0.13+0.04 to 0.14+0.04 mm.; hind tibia 2.7 to 3.1 mm. long, and more slender than that of oviparous forms; cornicles black, rather small, and 0.3 to 0.36 mm. across swollen base; cauda black and broadly rounded to slightly pointed; anal plate black, and broad.

Apterous oviparous.—Color brown to blackish brown; size 2.8 mm. long; hind tibia 1.8 to 2.2 mm. long, being shorter and somewhat thicker than those of apterous viviparous and armed with many small sensoria.

Lachnus glehnus Essig

This species is occasionally found to be fairly abundant in Utah, feeding upon the bark of small twigs of Colorado blue spruce, *Picea pungens.* The writer

first collected the pulverulent females in Logan, August 10, 1926. A second collection was made at Smithfield, July 18, 1927. Only wingless females were collected upon these occasions.

Enroute to the Grand Canyon, Arizona, several collections of this species were made upon Colorado blue spruce, July 12, 1925, at various places in the Kaibab Forest as well as at Grand Canyon. Specimens were received from C. B. Phillip, collected at Bozeman, Montana, August 11, 1926.

Apterous viviparous.—Dorsum nearly covered with a heavy whitish pulverulence; ground color of body brownish to dusky brown; size 3 to 4 mm. long; body pyriform; body and appendages armed with long, curved hairs; head with longitudinal median suture; rostrum scarcely reaching middle of abdomen; antennae fairly short, 0.9 to 1.22 mm. long; antennal III, 0.4 to 0.43 mm. long, and nearly always without sensoria; IV, 0.14 to 0.18 mm., and usually with one rather indistinct sensorium; V, 0.19 to 0.24 mm., usually with one secondary sensorium in addition to the larger primary sensorium; VI, 0.1+0.03 to 0.14+0.04 mm.; hind tibia 1.27 to 1.72 mm. long and fairly thick; cauda and anal plate rounded.

Lachnus curvipes Patch

Oviparous females of this large black aphid were present on fir, *Abies concolor*, on the campus of the Utah State Agricultural College, on September 20, 1926. The active females and nymphs were in colonies, feeding upon the bark of a few limbs. The nymphs were all black, but mature females had white flocculent material covering the dorsal surface of the abdomen, caudad of the cornicles.

Lachnus occidentalis Davidson.

Two collections of this species were taken in Big Cottonwood Canyon, June 29, 1929. The aphids were feeding upon the twig bark of white fir, *Abies concolor*. The flocculent material on the bodies of the young was noticeable. Many mature females had been killed by a hymenopterous parasite.

Lachnus burrilli Wilson

This species was present in considerable numbers in Providence Canyon, Utah, August 26, 1925. It was feeding upon the bark of a few trees, *Juniperus utahensis*. A large red and black ant was attending. A few specimens were taken in Logan Canyon, August 20, 1925.

Lachnus pulverulens Gillette and Palmer.

Two wingless females of this species were taken in Smithfield Canyon, August 24, 1925, feeding upon the bark of a juniper twig.

Genus *Eulachnus* Del Guercio.

Eulachnus rileyi Williams

This species is common on Austrian pine trees on the campus of the Utah State Agricultural College at Logan. In the fall the sexuals become very abundant. The alate forms in the spring lack sensoria on the third antennal segment; therefore, this form is being considered as *rileyi* instead of *agilis*.

Genus *Essigella* Del Guercio.

Essigella pini Wilson

Material collected on lodge pole pine, in Logan Canyon, June 23, 1925, appears to most closely resemble this form. The writer had been calling it *E.*

fusca G. and P., because of its size and color, but Professor M. A. Palmer calls attention to its resemblance to *E. pini,* and structurally it is closer to this form, especially in length of tibial hairs.

Genus *Tuberolachnus* Mordvilko.

Tuberolachnus viminalis (Boyer)

This large aphid occasionally becomes very abundant in northern Utah. It feeds upon the bark of several species of willows and attacks both the small twigs and the larger branches. On August 18, 1923, it was abundant on a few willow trees at Farmington. During the latter part of the summer and until mid-November, 1929, this aphid was abundant on *Salix alba* upon the campus of the Utah State Agricultural College Doctor H. J. Pack (deceased) called the writer's attention to the great numbers of this form, during early September. Many wasps of the species *Vespa occidentalis*[3] and many flies were constantly present around the trees infested with this aphid. Winged forms and pupal nymphs became increasingly abundant during the latter part of October and early November. Up to the middle of November, nymphs of all sizes were still present along with winged and wingless adults. On November 6 many syrphid larvae were attacking the colonies. At this time, a number of smaller colonies, consisting of from three to twelve specimens of this species, were observed feeding on boxelder shoots (*Acer negundo*), which were growing up among the branches of the willow tree. At

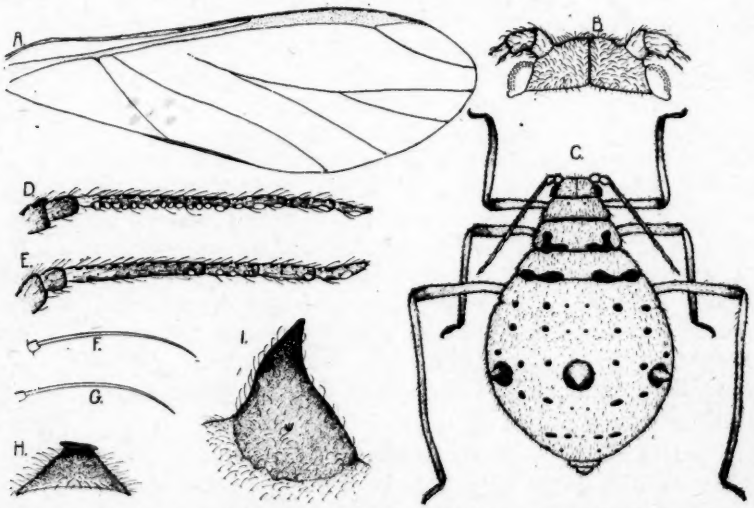


Fig. 6.—*Tuberolachnus viminalis* (Boyer).—A, Front wing; B, head of alate; C, apterous viviparous; D, antenna of alate viviparous; E, antenna of apterous viviparous; F, G, body hairs; H, cornicle of apterous; I, dorsal tubercle of fall apterous viviparous.

this time dense colonies on the willow were often from 1 to 2 feet long, principally upon the under part and sides of branches but frequently blackening the trunk or branch, over a large part of its surface. Colonies covered much of the bark from a foot or two above the base of the trees to 8 and 10 feet from the ground, the colonies often extending to the ends of the smaller twigs. When disturbed,

3.—Determined by Dr. J. Chester Bradley.

the aphids kick up the long hind legs, giving to the colonies a peculiar creeping appearance while the aphids are still attached to the bark by the mouth-parts. No males, oviparous females, or eggs were observed in material examined upon several occasions during November. The alate forms hold the wings roof-like over the body. The majority of the wingless aphids feed with the head pointed upward or toward the apices of the branches.

Apterous vivipara.—Size large, 5.1 to 5.3 mm. long and 2.8 mm. wide across abdomen, just in front of cornicles; ground color brown, covered with a grayish pruinose and thick covering of fine, long hairs, giving the aphids a grayish color, marked with black spots; rostrum rather long, reaching well beyond the third coxae; head somewhat rounded, with distinct median suture; antennae nearly half the length of body, and armed with numerous long, slender hairs; antennal III, 0.85 to 0.9 mm. long, and armed with one to three subcircular sensoria; IV, 0.32 to 0.34 mm., with one to four sensoria; V, 0.24 to 0.33 mm., without secondary sensoria; VI, 0.14 to 0.2 mm.+0.08 mm.; legs long and hairy; hind tibia 3.7 to 4 mm. long; abdomen with seven small lateral tubercles, and one large dorsal tubercle, the latter measuring about 0.62 mm. across base, and from 0.42 to 0.9 mm. from tip to most distant part of base, being usually longest in fall aptera; dorsal tubercle is dusky to black, pointed, and armed with numerous hairs; cornicles brownish-black, on raised, broad, hairy, bases; cauda and anal plate brown, broadly rounded, armed with numerous long hairs.

Alate vivipara.—Size large, 4.2 mm. long and 2 mm. wide across abdomen; body hairy, more flattened than that of apterous viviparous form, and covered with a grayish pruinose; rostrum long, reaching beyond third coxae; head somewhat rounded in front, and with a distinct median suture; antennae hairy and reaching abdomen; antennal III, 0.73 to 0.8 mm. long, and armed with 10 to 18 rather large subcircular sensoria in a row; IV, 0.25 to 0.3 mm., and with 3 to 5 sensoria; V, 0.22 to 0.3 mm., with 0 to 1 secondary sensorium, in addition to the large, distal primary sensorium; VI, 0.16 to 0.2 mm.+0.05 to 0.08 mm.; legs long; front wings with radial sector somewhat curved, and inserted some distance back from the long, narrow stigma; media twice branched, veins long and slender, bases obsolete; abdomen with small lateral tubercles and with the dorsal tubercle less developed than in the wingless forms; cornicles on dusky brownish, hairy cones; cauda and anal plate rounded, and armed with numerous long hairs.

Good, permanent mounts were secured from specimens of this form cleared by the following method: Hot water or 70 per cent hot or cold alcohol is used to kill the specimens. If desired, the aphids may be stored in 75 per cent alcohol for a considerable time, and then transferred to tap water, adding enough potassium hydroxide to make the solution almost saturated. They are stored in a warm place for 24 hours, then washed in tap water to remove discolored solution; caustic is again added to the water, making a strong solution. At the end of 36 to 48 hours, the specimens are ordinarily well cleared; they are then washed in running water or through a number of changes in water; next they are dehydrated by running up through 70, 85, 95, and 100 per cent alcohol, one hour in each strength, respectively. The alcohol is removed and a quantity of clearing cedar oil is poured

on the specimens. After standing in cedar oil from 24 to 48 hours the material is ready to mount into balsam or gumma damar.

Genus *Pterochlorus* Rondani.

Pterochlorus rosae (Cholodkovsky)

During 1929, this large, brown aphid was very scarce upon the rose bushes on the Utah State Agricultural College campus, whereas they had been abundant during the previous summer.

Genus *Anoecia* Koch.

Anoecia querci (Fitch)

This specialized form has been collected in several parts of northern Utah during the past few years. Dogwood and grasses are the common host plants.

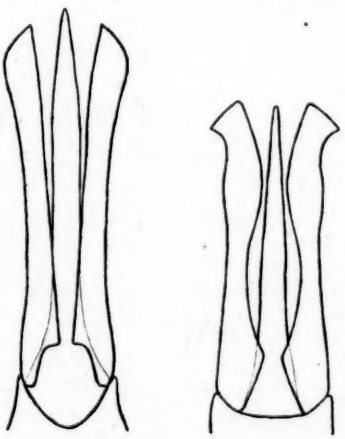
A REVISION OF THE NORTH AMERICAN SPECIES OF EANUS.*

BY W. J. BROWN,
Ottawa, Ont.

Eanus Lec.

Eanus LeConte, Smiths. Misc. Coll., 171, 1861.
Paranomus Kisenwetter (nec Chaudoir), Naturg. Ins. Deutsch., IV, 303, 1863.

This genus has been considered synonymous with *Ludius* Esch. but seems distinct by the following characters: form usually robust and strongly convex; front moderately convex, not margined; prothorax wider than long; elytral striae moderately impressed at base, very feeble or obsolete elsewhere; prosternal lobe rather short; the prosternal process in lateral aspect very strongly arcuate between the coxae and with the apical portion strongly oblique; the prosternal



albertánus decoratus

sutures almost straight; coxal plates narrow, more or less narrowed externally; tarsi filiform, the claws simple. Type *Limonius estriatus* Lec.

In *Ludius*, the body is rarely robust and is usually depressed, the elytral

*—Contribution from the Division of Systematic Entomology, Entomological Branch, of Agric., Ottawa.

striae are moderately impressed throughout, and the prothorax and prosternal lobe are usually longer. The most striking difference between these genera is in the form of the intercoxal process of the prosternum. In *Ludius*, the process is usually horizontal and is only feebly arcuate in lateral aspect in the more robust species. The species of *Eanus*, at least those collected by the author, are unable to spring into the air; this is probably due to the arcuate prosternal process and the robust form of the beetles.

All the species described below are clothed with sparse, short, brownish-yellow hairs. In all of which both sexes are known, the females are larger and more robust and, in the species with maculate elytra, have the pale areas somewhat larger. On the basis of male genitalic characters, the species may be divided into two groups. Into one group falls *costalis* Payk. of Europe and *decoratus;* these species cannot be separated by the genitalia. Into the second group fall the other species described below; these species likewise cannot be separated by the genitalia. These genitalic characters are illustrated by the accompanying figures. Besides the North American species, all of which occur in the more northern parts of the continent, *Eanus* contains several species which occur in the northern and alpine regions of Europe and Asia.

In determining the names that should be used for our species, the author has accepted as correct the dates printed on the publications in which the respective names first appeared.

TABLE TO SPECIES

1. Antennae black throughout; length 7 mm. or more ..... 1. *decoratus* Mann.
   Basal segments of antennae pale; size usually smaller ..... 2.
2. Elytron with basal pale area but never with pale lateral or apical spots .. 3.
   Elytron usually with two or three spots one of which is basal, rarely immaculate ..... 4.
3. Body subdepressed, not robust; length 6.2 mm. or more.. 2. *subarcticus* n. sp.
   Body convex, robust; size smaller ..... 3. *estriatus* Lec.
4. Elytron with three moderately large, very conspicuous yellow spots ..... 4. *maculipennis* Lec.
   Elytron immaculate or with two or three very small, inconspicuous yellow spots .....5. *albertanus* n. sp.

1. **Eanus decoratus** Mann.

Diacanthus decoratus Mannerheim, Bull. Moscou, XXVI. No. 3, 229, Aug. 24, 1853.
Limonius vagus LeConte, Trans. Am. Philos. Soc. (2) X, 434, (paper read Oct. 21), 1853.
Corymbites costalis Candeze (nec Paykull), Mem. Soc. Royale des Sci. de Liege, XVII, 177, 1863.

Male. Length 7-8 mm.; width 2.4-2.8 mm. Robust, subparallel. Blackish with distinct aeneous lustre; lateral elytral margin very narrowly and epipleura yellow; each elytron sometimes with a median, small, subbasal spot and a median, elongate, subapical spot yellow, these spots never very distinct and not sharply delimited; tibiae and tarsi brown or brownish-yellow; antennae black, never pale at base.

Antennae slightly more than two-fifths as long as the body; the third segment similar in form to and slightly longer than the second, three-fourths as long as and two-thirds as wide as the fourth. Front usually with a broad, shallow,

but very distinct concavity between the eyes; rather finely and closely punctate like the pronotum.

Pronotum three-fourths as long as wide, not constricted near the apex; the sides feebly arcuate, moderately sinuate before the hind angles which are moderately divergent and obsoletely carinate. Disk strongly convex; rather finely, moderately closely punctate. Scutellum feebly convex, not carinate.

Elytra subparallel, not wider posteriorly. Striae distinctly impressed at base, obsolete elsewhere; intervals rather finely and moderately closely punctate.

Ventral side of prothorax sometimes alutaceous, finely and closely punctate. Metasternum, abdomen, and femora finely and closely punctate, the abdomen alutaceous on the sides. Hind coxal plates rather strongly narrowed externally, at the trochanters three times as wide as at the external extremity. Lateral lobes of genitalia obliquely truncate at apex, the external apical angle of each prolonged into a subacute tooth.

Female. Length 8-9 mm.; width 3.4-3.8 mm. Elytron with the subbasal spot distinct and larger, usually twice as large as the scutellum; the apical spot usually large, distinct, and attaining the apex, sometimes absent.

This species is distinguished by the large size, color, concave front, and the antennal characters. The above description is drawn from fourteen males and four females. One of the latter was taken near Sixty Mile River, 141 Meridian, Yukon Territory, (T. P. Reilly). The other specimens were taken by the author at numerous localities on the north shore of the Gulf of the St. Lawrence between Seven Islands and Greenly Island.

The present species was described from Kodiak Island, Alaska, evidently from the female, for Mannerheim gives the length and width as 8 mm. and 3.5 mm. and describes the elytral spots as follows: "macula rotundata basali, margine laterali cum epipleuris, ad apicem in maculum majorem subhamatum dilatata rufo-ferrugineis." Three of the four females at hand, including the one from Sixty Mile River, fit this description. LeConte's *vagus* was described from the northern shore of Lake Superior and is represented in the LeConte collection by a male and a female; the latter agrees well with our Sixty Mile River specimen. Candeze pronounced *vagus* a synonym of the European *costalis* Payk. after he had studied specimens of the former sent by LeConte. However, the study of three male specimens of *costalis,* kindly sent by Dr. W. Horn, shows that Candeze was in error. These European males are larger and more robust, resembling closely in size and form the females of *decoratus;* they have the elytra immaculate and the striae very feebly but more distinctly impressed, the third antennal segment slightly shorter than the second and the fourth relatively wider, and the hind coxal plates only twice as wide at the trochanters as at external extremities.

2. **Eanus subarcticus** n. sp.

Male. Length 6.2-6.7 mm.; width 2-2.2 mm. Subdepressed, not robust, subparallel. Blackish with distinct aeneous lustre; elytra with basal fifth, epipleura, and lateral margin except at apex yellow, the basal pale area sometimes reduced to a large spot betwen humerus and scutellum on each side; tibiae and tarsi brown or brownish-yellow; antennae black, the first and second segments brownish-yellow.

Antennae half as long as the body; the third segment slightly longer than the second, similar in form to and very slightly shorter and narrower than the fourth. Front without a concavity, rather finely and closely punctate.

Pronotum three-fourths as long as wide, sometimes with a feeble trace of an apical constriction; the sides moderately arcuate, moderately sinuate before the hind angles which are rather strongly divergent and not carinate. Disk moderately convex; finely and closely punctate. Scutellum flat, not carinate.

Elytra subparallel. Striae feebly impressed at base, indistinctly so elsewhere; intervals finely, rather closely punctate.

Ventral side of prothorax alutaceous; the prosternum not strongly so, finely and closely punctate. Metasternum, abdomen and femora finely and closely punctate. Hind coxal plates feebly narrowed externally, at the trochanters twice as wide as at the external extremity. Genitalia as in *albertanus*.

Female.—Unknown.

Holotype.—Harrington Harbor, Que., July 2, 1929, (W. J. Brown); No. 3091 in the Canadian National Collection, Ottawa.

Paratype.—1, same data as holotype; 1, Mutton Bay, Que., July 11, 1929, (W. J. Brown); 1, Bradore Bay, Que., July 17, 1929, (W. J. Brown).

This species is no more robust and convex than an average species of *Ludius;* in this it differs from all other species of the present genus.

3. **Eanus estriatus** Lec.

Limonius estriatus LeConte, Trans. Am. Philos. Soc. (2) X, 433, 1853.

This species is known only from the types, two specimens in the LeConte collection. These specimens measure 5.9 and 6.1 mm. and are probably females. They are robust, blackish with an aeneous lustre, and have the elytra in basal fifth and the lateral margin yellow. The third antennal segment is subequal in length to and slightly narrower than the fourth. The pronotum is constricted near the front angles, has the side margins strongly arcuate and the hind angles strongly divergent. The types are from Eagle Harbor, Lake Superior.

The species resembles *subarcticus* in antennal and color characters but is smaller and much more robust than the females of the latter can possibly be.

4. **Eanus maculipennis** Lec.

Eanus maculipennis LeConte, Smiths. Misc. Coll., No. 167, 85, March, 1863.
Corymbites pictus Candeze, Men. Soc. Royale des Sci. de Liege, XVII, 90 and 177, Mai, 1863.

Male. Length 4.6-5.7 mm.; width 1.6-2.1 mm. Robust, moderately convex, elongate oval. Blackish with distinct aeneous lustre, marked as follows: basal four antennal segments, legs except femora, epipleura, elytral spots, and sometimes the extreme lateral margin of elytra, yellow; femora brownish with the bases and apices broadly yellow; each elytron with a subbasal spot at least twice as large as the scutellum, a submedian oblique vitta which extends from lateral margin to middle of elytron and which is rarely shortened to form a triangular spot on lateral margin at basal third, and a spot at apical fourth which extends from margin to second or third stria and which is slightly larger than the subbasal spot.

Antennae slightly more than two-fifths as long as the body; the third segment slightly shorter and narrower than the fourth. Front without a concavity, finely not closely punctate.

Pronotum three-fourths as long as wide; the sides constricted behind the front angles which are right or subacute; the side margins rather strongly arcuate behind the constriction, moderately sinuate before the hind angles which are moderately divergent and not carinate. Disk strongly convex; finely, not closely punctate. Scutellum feebly convex, not carinate.

Elytra subparallel or a little wider at apical third. Striae distinctly impressed at base, indistinctly so elsewhere; intervals finely, rather closely punctate.

Ventral side of pronotum and abdomen finely and closely punctate, the former not alutaceous. Metasternum and femora very finely, sparsely punctate. Hind coxal plate feebly narrowed externally, at the trochanters twice as wide as at the external extremity. Genitalia as in *albertanus*.

Female. Length 5.7-6.2 mm.; width 2.1-2.3 mm. Elytral spots slightly larger. Antennae slightly shorter, two-fifths as long as the body. Pronotal side margins more strongly arcuate near apex; the disk more convex. Elytra wider at apical third.

This species is easily recognized by the elytral maculation. The description above is drawn from forty six specimens from many localities on the north shore of the Gulf of the St. Lawrence between Thunder River and Bradore Bay. The species was described from Labrador; the type of *pictus* was from "Canada."

5. **Eanus albertanus** n. sp.

Male. Length 5.7 mm.; width 2.5. Robust, moderately convex, elongate oval. Blackish with distinct aeneous lustre, marked as follows: basal two or three antennal segments, legs except femora, elytral epipleura, and sometimes elytral spots, yellow; femora blackish with bases and apices yellow; elytron frequently marked with yellow as follows: narrow reflexed lateral margins in apical two-thirds, a subbasal spot between humeral umbone and scutellum slightly larger than the latter, a smaller sublateral spot at basal fourth, and a small median spot at apical fifth; these, especially the sublateral spot, often reduced or entirely absent.

Antennae two-fifths as long as the body; the third segment equal in length to and considerably more slender than the fourth. Front without a concavity; finely, not closely punctate.

Pronotum three-fourths as long as wide; the sides moderately and variably constricted behind the front angles which are right or acute; the side margins rather strongly arcuate behind the constriction, almost straight and slightly oblique in basal two-thirds, the sinuation before the hind angles very feeble; these angles feebly divergent, not carinate. Disk strongly convex; finely, not closely punctate. Scutellum feebly convex, sometimes feebly carinate.

Elytra subparallel. Striae distinctly impressed at base, feebly at apex, and obsolete elsewhere; intervals finely, rather closely punctate.

Ventral side of pronotum and abdomen finely and closely punctate, the former not alutaceous. Metasternum and femora very finely, sparsely punctate. Hind coxal plates feebly narrowed externally, at the trochanters twice as wide as at the external extremity. Each lateral lobe of genitalia with the inner margin straight, the outer rounded near the extremity to form an acute apex.

Female. Unknown.

Holotype.—Banff, Alta., July 13, 1922, (C. B. D. Garrett); No. 2944 in the Canadian National Collection, Ottawa.

Paratypes.—5, same data, July 13 and 18, 1922.

This species is closely allied to *maculipennis* but differs constantly in color and in having the third antennal segment longer.

BOOK NOTICES

Manual for the Study of Insects, 19th edition, revised;—by J. H. Comstock, A. B. Comstock, and G. W. Herrick. Comstock Publishing Co., Ithaca, N.Y. 401 pp., 633 figures, 3 plates. Price $4.00.

In this revision of one of America's pioneer textbooks for elementary courses in Entomology, the original form and arrangement remain practically unaltered. The first two chapters deal with the near relatives and structure of insects, the remaining 25 chapters dealing with the orders and their main families of insects, the smaller families being listed at the end of the discussion on the group.

The text matter has been brought up to date, condensed, and simplified, so that the Manual fulfills the requirements of a textbook for the beginner in the study of Entomology. R.H.O.

A General Textbook of Entomology, second edition, revised;—by A. D. Imms, M.A., D.Sc., F.R.S., Rothamsted Experimental Station, Harpenden, England, published in America by E. P. Dutton & Co., Inc., New York. Price $10.80.

The author has not departed from his original treatment of the field of Entomology. Part I, deals with the Anatomy and Physiology of Insects in a clear, comprehensive manner. Part II, similarly deals with the development and metamorphosis of insects under the captions of Embryology, and postembryonic development, or metamorphosis and development of the imago. Part III, comprising about two-thirds of the book, deals with the classification of insects in which the author divides them into Apterygota, including 3 orders, and the Pterygota further subdivided into the Exopterygota including 11 orders and the Endopterygota including 9 orders.

The bibliography, including references to many original papers, is topically arranged, greatly facilitating its use.

In this revision the author has included, supplementary references, many of them to recent works, an addenda of notes on many recent advances in the subject, and a revision of the classification of the orders Dermaptera, Isoptera and Thysanoptera.

This comprehensive work readily takes its place as an outstanding textbook for courses in Entomology, as well as being a valuable reference to all workers in the subject, whether in the laboratory or field, professional or amateur.

R.H.O.

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